

Is Endodontic Treatment Necessary During Coronectomy Procedure?

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Purpose: Close proximity of the inferior alveolar nerve (IAN) to the third molar roots can result in nerve injuries during extraction of third molars. Consequently, it is necessary to determine the relationship of the nerve and roots to avoid damage to the IAN. Computed tomography scans are widely used to determine the correct relationship between the IAN and lower third molars.

Patients and Methods: The study consisted of 10 patients with 16 lower third molars in close relationship with the IAN who were divided into a study group and a control group. The patients in the study group were treated via coronectomies performed with endodontic treatments. The patients in the control group underwent coronectomies without endodontic treatment. The patients were followed up for at least 1 year.

Results: We had to extract 7 of the roots because of the infection in 8 patients belonging to the study group, which were treated endodontically. Moreover, there were 3 cases of IAN damage because of the extraction in the study group. However, in the control group, no infection was determined and IAN damage was absent.

Conclusion: Coronectomy appears to be a reliable technique to protect the IAN from damage. This procedure has a low incidence of complications. Endodontic treatment does not affect the success of this method according to our results.

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Inferior alveolar nerve (IAN) injury encountered during surgical operations can result in various levels of complications¹ that mostly occur during impacted mandibular third molar removals.¹⁻⁵ Mandibular posterior implant placements, bone graft harvesting, and orthognathic surgeries are other operations that can give rise to IAN damage.^{6,7} The reason for this complication during

impacted third molar removal is thought to be the close relationship of the root tips with the IAN.¹⁻¹² This close proximity may lead to temporary or permanent paresthesia after the tooth removal. Permanent paresthesias are generally induced by the deterioration of nerve integrity or degeneration under compressive stresses as a result of excessive trauma. This condition usually occurs in cases where the IAN is placed between the roots, which are fused at the tips.^{2,3,5} When the radiologic markers of proximity of the IAN to the root of the third molars are present, the possibility of damage can be as high as 35%.²

There are several articles in the literature indicating that the relationship between the IAN and the mandibular third molar could be determined by conventional periapical and panoramic radiographs. According to those articles, there are 3 radiographic features needed to make a decision regarding whether there is a close relationship. These are as follows:

1. Alteration in the trace of the mandibular canal.
2. Radiolucency over the image of the root tips.
3. Interruption of the continuity of the lamina dura over the wall of the mandibular canal.^{3,4,6,8-10,12}

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Although it is known that the proximity of the IAN and mandibular third molars can be detected by conventional imaging techniques, it can sometimes be impossible to determine in the absence of computed tomography (CT) scanning images.¹³ The disadvantage of CT is the relatively high radiation dose and cost. However, the high radiation factor can be eliminated with the use of cone-beam CT technology, which is currently available in a dental practice.¹⁴⁻¹⁶

To avoid the possibility of the IAN injury during third molar removal, coronectomy can be performed. Coronectomy is the removal of the crown of a tooth with the root being left in place.¹⁻⁴ In the literature the coronectomy technique has been widely used to protect the IAN from injuries occurring as a result of impacted mandibular third molar removals. The crown and one third of the coronal section of the roots are removed,^{2,5} and no procedure is performed on the section that is in close relation to the IAN. Therefore IAN damage is out of consideration.

The most common indication for impacted third molar removal is eruption difficulties leading to pericoronitis by the aid of coronectomy; the crown causing the pericoronitis and the dental follicle, which are the chief reasons for inflammation, are removed. Therefore the problem is resolved.¹⁻³ In the literature the discussion on this subject is focused on the infection or a similar complication caused by the root that was left and especially the partially resected pulp tissue.^{17,18}

The aim of this study is to determine the efficacy of the endodontic treatment with the coronectomy procedure and to discuss the necessity for endodontic treatment during coronectomies.

Patients and Methods

The study was performed on 16 impacted mandibular third molar teeth in 10 patients (4 male patients with a mean age of 23 years and 6 female patients with a mean age of 19 years) who were referred to the Department of Oral Diagnosis and Radiology and Department of Oral and Maxillofacial Surgery, Gülhane Military Medical Academy, between the years of 2004 and 2005 (Table 1). All patients were thoroughly informed about the procedure and signed a written consent form. In addition, local ethics approval was

Table 1. NUMBERS AND MEAN AGES OF PATIENTS

	No. of Patients	Mean Age (yr)
Female	6	19
Male	4	23

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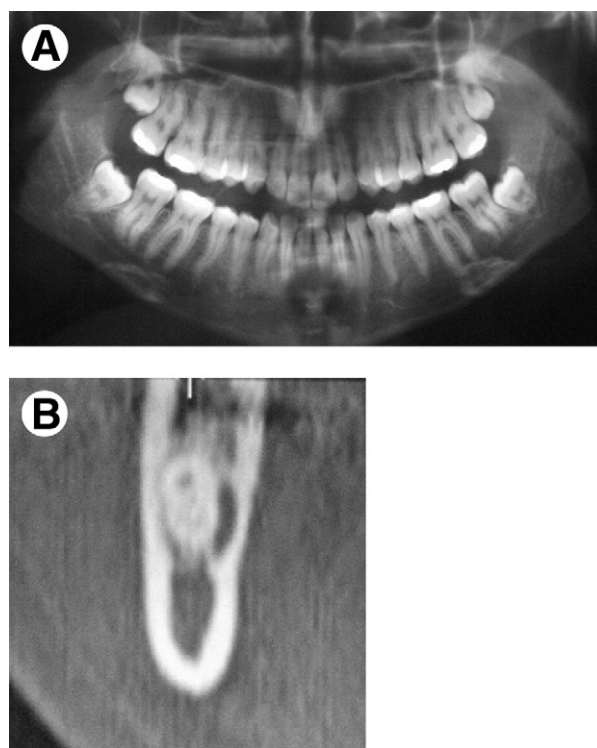


FIGURE 1. A, The relationship between the impacted lower third molar tooth roots and the IAN is detected on panoramic radiographs. B, Spiral tomographic cross-sectional slices verified the relationship between the same patient's IAN and lower third molar roots.

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obtained for the main study (GMM 68/373; June 30, 2006).

The inclusion criteria was the high risk of injury to the IAN based on panoramic radiographs. The relationship between the impacted tooth roots and the IAN is detected by panoramic radiographs and evaluated with respect to the criteria of Howe and Poyton.⁸ Where the panoramic images were insufficient to describe the contact between the roots and the IAN, the spiral tomographic cross-sectional slices were used to determine the exact relationship (Fig 1). The patients enrolled in the study met the following inclusion criteria: 1) cooperation with the study and postoperative follow-up and 2) absence of uncontrolled medical conditions such as diabetes mellitus, immune compromise, head and neck radiotherapy, calcium imbalance, and so on. Exclusion criteria were 1) the presence of active infection or tooth mobility; 2) uncontrolled systemic diseases (diabetes mellitus, immune compromise, head and neck radiotherapy, calcium imbalance, and so on); 3) radiation to the head and neck; and 4) local pathologic conditions related to the roots of the impacted molars. Furthermore, angulations of third molars were disregarded.

Table 2. TREATMENT PROTOCOLS ACCORDING TO GENDER

	Coronectomy	Coronectomy Plus Root Canal Treatment	Single Side	Left and Right
Female (n = 6)	4 (n = 2)	4 (n = 4)	4 (n = 4)	2 (n = 2)
Male (n = 4)	4 (n = 2)	4 (n = 2)	—	4 (n = 4)
Total (N = 10)	8 (n = 4)	8 (n = 6)	4 (n = 4)	12 (n = 6)

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The study consisted of 10 patients with 16 lower third molars in close relation with the IAN who underwent coronectomies and were divided into a study group and a control group. Eight teeth in 5 patients in the study group were treated by coronectomies performed with root canal treatment. Eight teeth in 5 patients in the control group underwent coronectomies without endodontic treatment (Table 2). The operations were performed with patients under local anesthesia. None of the cases were prescribed preoperative prophylactic antibiotics; however, they were prescribed postoperative anti-biotherapy as a measure of surgical wound infection. The patients used a povidone-iodine mouthwash before surgery. Coronectomy was performed by use of the buccal approach in all cases. All coronectomies were performed by the same surgeon. In addition, all endodontic treatments were performed by the same endodontist.

In the study group, pulpectomy and biomechanical preparation were performed (Fig 2). The root canals were irrigated with a saturated solution of calcium hydroxide with the purpose of making the dentin alkaline. Thereafter the canals of the third molars were filled with the aid of a Lentulo spiral (Dentsply, Petropolis, Brazil). Finally, mineral trioxide aggregate (MTA) cement (Anglinos, Londrina, Brazil) was used

as a canal-filling material. The endodontic procedure was performed under aseptic conditions in the operating room.

The buccal approach was preferred for access in all cases, and the crown including the dental follicle was removed with one third of the root coronally. In practice, while separating the crown from the root, a slope is formed, the level of which decreases from buccal to lingual (Fig 3). This inclination causes a sharp edge form of the root at the buccal alveolar crest level while leaving 3 to 4 mm of the root down below the lingual alveolar crest level. To overcome this situation, after the separation of the crown, the buccal root surface was reduced to the lingual root level by the help of a carbide rose-head bur. After irrigation of the surgical area with copious saline solution, the wound edges were closed primarily. In the study group, after removal of the pulp and biomechanical preparation, the canals were filled with MTA (Fig 4). To prevent over- or underfilling of the canals, control periapical radiographs were taken periodically. All the root canals in the study group were adequately filled to the apices. Brand new sharp burs were used for every operation so as to excise the crown without mobilizing the roots. In the control group the pulp was left in place (Fig 5).



FIGURE 2. DEMO device for biomechanical preparation (Maillefer Dentsply, X-Smart, Ballaigues, Switzerland).

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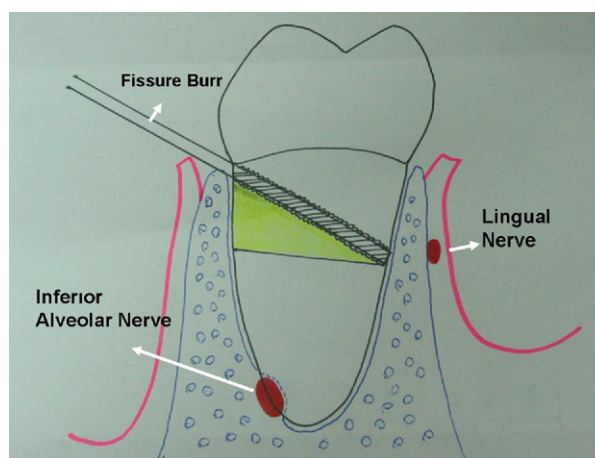


FIGURE 3. Technique for removal of lower third molar.

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At the end of the first, third, and sixth months of the postoperative follow-up period, control panoramic radiographs were taken (Fig 6). Finally, 1 year after the operation, the last panoramic radiographs were taken for assessment of the coronectomy sites.

Results

The results of both groups are shown in Table 3. In the study group, 7 roots of the third molars had to be removed because of infection after the procedure. Infections appeared right after the coronectomy and root canal treatment. However, in the control group, only 1 root had to be removed because of opening of the surface. This open wound caused an infection during the healing period. In addition, 3 patients in the study group with the need for extraction had temporary loss of sensation on their IANs after extraction.

In the control group, we surprisingly determined that the roots had moved into the coronal direction at

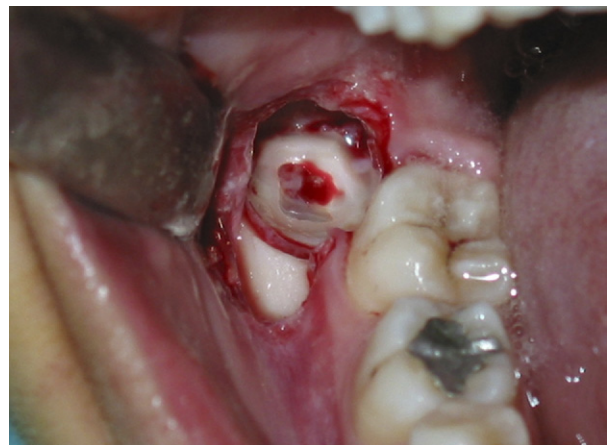


FIGURE 5. The pulp was left in place in the control group.

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1 month after the procedure. In this way the close relationship between the roots and IAN had disappeared (Fig 7).

Discussion

Damage to the IAN can occur during routine extraction of impacted lower third molars.^{8,11,19} Neural complications in these situations are observed mostly when the apices of the wisdom teeth and IAN are in close anatomic proximity.¹⁻⁵ Even though panoramic

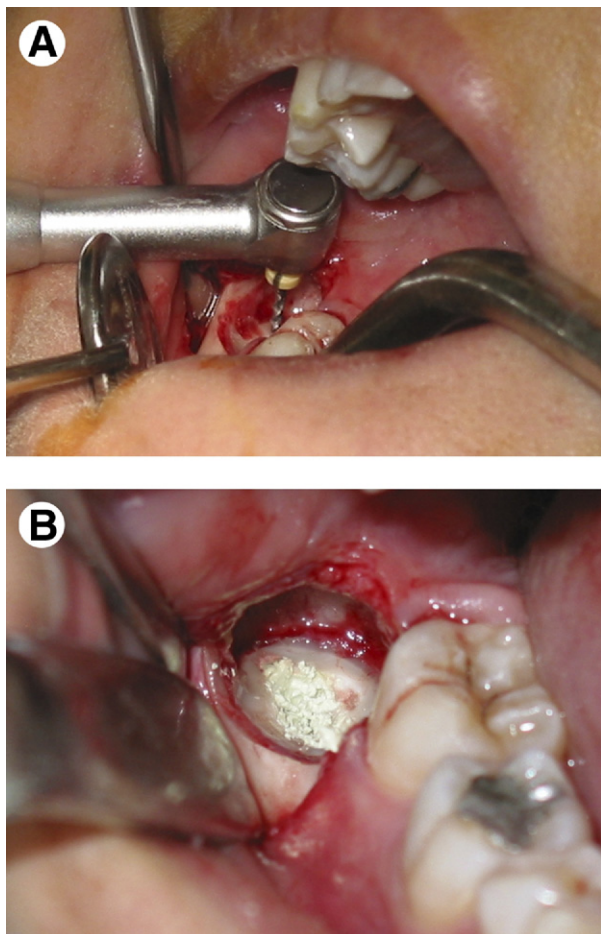


FIGURE 4. A, Removal of pulp and biomechanical preparation of roots. B, Filling of canals with mineral trioxide aggregate.

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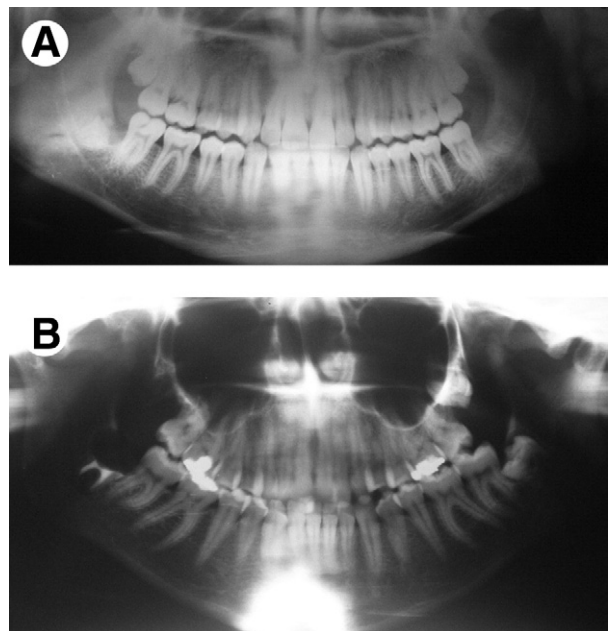


FIGURE 6. A, Panoramic radiograph taken 6 months after coronectomy. B, Panoramic radiograph taken 6 months after coronectomy plus root canal treatment.

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Table 3. RESULTS

	Complications	No Complications
Coronectomy	1	7
Coronectomy plus root canal treatment	7	1
Total	8	8

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radiographs are able to show the properties of that region,^{3,6,8,10,12} detailed observation of this relationship is possible only on cross-sectional spiral CT scans.^{4,20-22} The disadvantage of CT is exposure to a greater amount of radiation in patients; however, new cone-beam CT scanners offer reduced exposure times with minimal radiation.¹⁴⁻¹⁶ In our study, we did not benefit from the CT scans directly in all cases. CT scans were used only in cases in which difficulty was assessed with orthopantomography.

Ecuyer and Debien²³ were the first to describe the coronectomy procedure, and after much research, this technique is considered very useful to prevent any damage to the IAN during removal of impacted teeth adjacent to the inferior alveolar bundle.¹⁻⁵ The remaining pulp in the apex of a root, which was subjected to necrosis over time after coronectomy, was the main target for serious discussions in the past because the necrotic pulp was considered the trigger for apical periodontitis or orofacial infections.^{17,24} Because of the present dilemma and existing suspicions about the latter, we studied the efficacy of removing pulpal tissue and remnants during coronectomy and assessed its contribution to the issue.

In this study the coronectomies were performed according to Pogrel et al¹ and the root fillings made with MTA. Neither pathology nor infection was encountered in the control group during the follow-up period; however, secondary surgery was performed to extract the remaining teeth in the study group with MTA root fillings, where 7 of 8 teeth were infected postoperatively. Complications observed after extractions of impacted third molar teeth were estimated to occur in direct relation with the duration of surgery.²⁵ Prolongation of surgical time was considered to increase risk of infection. In our study, a similar result was obtained because application of MTA root canal filling caused considerable prolongation of the surgical time. The higher incidence of postoperative infection of that group could be related to this phenomenon. It is known that MTA is an effective preparation for apexification and root canal-filling material.²⁶ Because of this, we preferred to use MTA in our study. Therefore we decided that the abundance of postoperative infections in the group in which coronectomy

and root canal-filling material were applied did not originate from the features of the root canal-filling material.

In the control group, only 1 tooth had to be extracted because of postoperative infection after coronectomy, but that complication occurred almost 1 year later, and the remaining root moved in the coronal direction by exposure through the mucosa. We think that the lack of successful primary wound closure was responsible for this complication.

In the control group, the teeth remained vital, because the pulp was left vital in the apices. However, extra channel treatment adds invasiveness to the coronectomy procedure. The pulp is extirpated and channels instrumented to some extent, which is responsible for extra mobility of the roots. This was confirmed in our study during the second surgeries, during which mobility was assessed in all extracted teeth. On the other hand, animal studies have shown that vital roots remain vital with minimal degenerative changes. Osteocementum usually extends to cover the roots.²⁷⁻²⁹

Morphology of the roots is another factor contributing to successful coronectomy. Small and conical roots are prone to easier mobilization, and this could be the reason for the occurrence of apical infection. Renton et al³ reported postoperative failure in 36 cases among 94 coronectomy patients. They correlated failure to the inappropriate morphology of the small and conical roots. We preferred to extract the teeth with similar morphology in our study instead of trying to perform coronectomy. Nerve damage occurring after extraction of such teeth was considered to be transient; in addition, such a neural complication could heal more quickly. Renton et al pointed out the rise in apical infection in the remaining roots after 2 years of follow-up. We did not find any problems after the second postoperative year in all cases treated by coronectomy, and our follow-up continues.

In this study we observed coronal movement of the resected roots in accordance with most of the previous studies.^{1,3,4} In the control group, a root causing

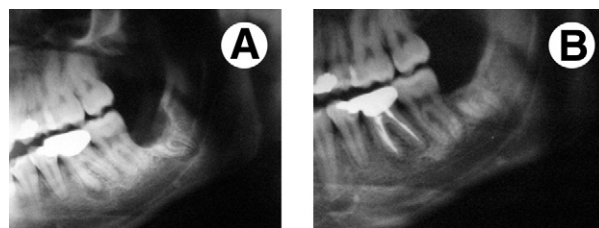


FIGURE 7. A, Panoramic radiograph taken immediately after coronectomy procedure. B, Panoramic view in same patient taken 2 years after procedure, showing eruption of impacted roots.

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infection was extracted and the IAN was protected in that way. The same eruption could not be observed in the study group because of initiation of infection in the early period. One root in the study group did not erupt; however, eruption occurred in the control group because vitality might be responsible for such root movement.

On the basis of the findings from this study, we conclude that coronectomy is a safe and reliable method of avoiding injury to the IAN when removing appropriate third molars. In addition, carrying out intraoperative root canal therapy does not add anything to the procedure, considerably increases the complication and infection rates, and is therefore not recommended. Furthermore, movement of the residual roots does occur, but the direction of movement is away from the nerve when they are supposed to complicate IAN, and thus it is possible to extract teeth without any neural complications during the sometimes problematic postoperative period.

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